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THE MANAGEMENT OF GREENHOUSES,

BY

EDWIN LONSDALE.

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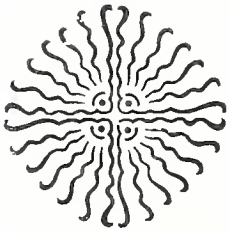

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PREFACE.

Harrisburg, Pa., August 1, 1902.

The following Bulletin No. 97, upon "The Management of Greenhouses," by Edwin Lonsdale, of Wyndmoor, Pa., will commend itself as being worthy of the attention of florists and greenhouse managers everywhere in the Northern States.

Mr. Lonsdale has had large experience in this work, and was chosen for the preparation of a bulletin upon Greenhouse Management because of his success in this direction, and his eminent fitness for the discussion of the difficult questions which confront the grower of flowers and ornamental plants, whether for home adornment or for the general market.

Few men in the midst of active business, as is Mr. Lonsdale, are willing to take the time to write out their experience, in readable form for public use, and all who are interested in floriculture, or in the cultivation of decorative plants, can, therefore, well be thankful that the author has sacrificed, for their benefit, his hours needed for rest and recuperation.

JOHN HAMILTON,
Secretary of Agriculture.

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LETTER OF TRANSMITTAL.

Wyndmoor, near Chestnut Hill, Pa.

Hon. John Hamilton, *Secretary of Agriculture, Harrisburg, Pa.:*

Dear Sir: Acting according to your request received some time ago to prepare a pamphlet on "The Management of Greenhouses," same is herewith submitted.

While greenhouses for the growing of a general collection of plants have long been in use, the industry for the exclusive use of greenhouses for the growing of cut flowers, especially for winter, is of comparative recent development, dating back not much more than twenty-five years in Pennsylvania.

In the spring of 1880, an establishment was started near Philadelphia—modest in its proportions, it is true—in which to grow cut flowers to be disposed of under wholesale arrangements. There were three greenhouses, each one hundred feet long. The one for roses was twenty-three feet wide. In that house were grown five varieties, namely: Safrano, Isabella Sprunt, Bon Silene, Niphetos and Perle des Jardins, none of which are grown in any quantity for winter blooming at the present time in or near to the larger cities. Another house was for Carnations, and the variety grown was principally, King of the Crimsons. This variety found ready sale on account of its color to help out the celebrated crimson rose, General Jacqueminot ("Jack"), which was at the height of its popularity about that time. The third house was devoted entirely to Smilax, so called, by florists, botanically known at that time as *Myrsiphyllum asparagoides;* now, according to Bailey it is classified as an *Asparagus, A. medeoloides.* At this time little or no other green was grown to associate with flowers, excepting, possibly, Maidenhair Fern—*Adiantum cuneatum*—and that in very limited quantity. This house contained about 3,500 plants, which proved at that time to be more than Philadelphia could use to advantage. Florists in the cities of New York and Washington, however, were only too glad to take the surplus, and for several years, florists of the two cities named depended largely upon this establishment for much of their Smilax supply. Smilax was at that time an excellent paying crop, frequently yielding one dollar per square foot, which is considered very profitable.

Other greens have come since that time which are more popular than the older Smilax, as *Asparagus plumosus nanus, and A. Sprengerii*, the former of which twines itself on strings as does the Smilax, and houses very high are built especially for its cultivation; whereas, *Sprengerii* grows in plumes or sprays and are cut in lengths from nine to eighteen inches, and are sold in bundles of about twelve plumes each, averaging about fifty cents per bunch.

Asparagus tenuissimus, known to some extent as "Mermaid's Hair," was the first to dispute the position occupied for so long by Smilax, but for some reason it seems to have entirely gone out of cultivation, especially about the larger cities. According to Bailey, *tenuissimus* is a variety of *plumosus nanus;* which would never be suspected by the casual observer. Mermaid's Hair, describes it very well, being very finely cut indeed, resembling greenish mist.

Another green grown is the *Adiantum Farleyense*, the Queen of Maidenhair Ferns, and it richly deserves that name. No fern, however, at present in commerce, is so well suited to go with flowers as are the different varieties of Aspargus on account of the tendency to wilt so soon. There is, however, a new Adiantum (Maidenhair Fern) to be sent out soon which is similar to *Adiantum cuneatum*, which is far superior to any other in its lasting qualities after being cut, and for that reason when it becomes better known must become popular.

The general principles laid down in the following pages for the guidance of those who have a desire to embark in the greenhouse business will, I hope, be found to be helpful.

Respectfully submitted,

EDWIN LONSDALE.

THE MANAGEMENT OF GREENHOUSES.

By Edwin Lonsdale, *Wyndmoor, Pa.*

It can hardily be questioned, I believe, that the growing of plants in the window was the fore-runner of the greenhouse structures of to-day, in which to shelter exotic and other tender plants from frost and to force flowering plants into bloom out of their natural season. Great improvements have been made in the building of greenhouses during the past twenty-five years; especially does this apply when used in floriculture and the growing of plants for decorative purposes, which come under the head of ornamental horticulture.

The first greenhouse built would, it is natural to suppose, be an attachment to a residence, and in those early days what are termed "lean-to's" were the most generally in use. The term "lean-to" means that the wall, which was a part of the residence, upon which the greenhouse appeared to lean was utilized as one side of the structure, and the sash-bars were secured at the top to the house side and at the lower end to a wall low enough to give the necessary angle to allow rain and snow to fall naturally therefrom, and at the same time to give the sun an opportunity to reflect his life-giving rays therein. And the methods employed in these days also are to build greenhouses to catch every possible sun-ray, that is to say, when such a structure is erected for the purpose of producing flowers in the more or less frosty nights and cloudy days of winter, with some exceptions, which will be noted in due course.

The variety in styles of greenhouses now in use is almost infinite. Indeed each individual has his own ideas which he has naturally embodied into a plant-growing structure.

To advert for a moment to growing plants under glass, flowering plants are especially in mind. Among the most popular flowering plants for cut flower purposes to-day that are hardy, or very nearly so, we note here.

We will place the Rose first, and with very slight protection from severe frost, all the popular varities used in the winter season are, speaking generally, hardy. It is also true to a great extent with the Carnation and the Chrysanthemum; and in the Lily of the Valley it is quite true as to its thorough hardiness, and which, by the way, may be had in flower, if due notice is given, on any day at any

time of the year. This is brought about by a systematic arrangement with cold storage, in which to keep the roots dormant until the proper time.

We have the exotic Orchids for cut flowers, but Roses are really the most popular flowers before the public at the present time, and observers of events feel they can safely say that the Rose, the "Queen of Flowers," will for all time hold the affections of the people. To the laymen, if I may be allowed to so designate those who are not in close touch with the forcing of Roses for cut flowers commercially, it may seem strange when I say that out of hundreds of varieties and species of Roses in and out of catalogues and books of reference, there are less than a dozen which are recognized as being both profitable and popular for the purpose indicated.

As to varieties, American Beauty stands first on the list. Its cerise color is too well known to need anything more than a passing mention here. Its sweet June Rose scent endears it to all, besides being a Rose which when well grown may be cut with almost any length of stem desirable. For special purposes, flowers with stems eight feet long have been cut—these are the most expensive of any; not that the individual flower is any better on these extremely long stems than on shorter ones, because they are not. Frequently the flowers on a stem a foot long or even shorter will be equally as perfect in form, size, color, and, of course, fragrance, as those with a much longer stem. It is the scarcity of these very long stemmed flowers, and the special uses to which they may be put, which makes them more valuable and consequently higher in price than the shorter ones. This Rose may be bought all the way from one dollar to twenty-five dollars per dozen, according to the season of the year and the length of stem and quality of the flower, but the fragrance, bear in mind, may always be found in the flower no matter how long or how short the stem or how far from perfect may be the flower in form.

The origin of American Beauty Rose is in doubt. A claim is made that it was discovered in the garden of the late historian, George Bancroft, at Washington, D. C., who was a great lover of Roses and had a collection of numerous and choice varieties. It was the gardener of Mr. Bancroft who discovered it first, but whether he thought he could see that it possessed a possible forcing quality or whether by accident it was found out, has not to my knowledge been placed on record. Certain it is that more area under glass is devoted to its culture for the large cities, as Philadelphia, New York, Chicago and Boston, than all the other varieties of winter forcing varieties combined.

Although we owe much to the florists of Boston for having been the pioneers in the development of Rose forcing in general, yet the

American Beauty, for some unaccountable reason, has not in the past been grown thereabouts entirely successfully until the past year or two when better reports have been recorded; consequently the Boston retail florists have been depending upon the Rose growers about Philadelphia and some other localities for the greater part of their supply therefor. There are evidences, however, that many more of the flowers of the American Beauty will be home grown for the Boston supply in the future than there has been in the past, for some immense structures have been built near to that city for the purpose indicated during the past year or two. Rose houses 750 feet long and 25 feet wide have been built within the past two years, in which, we believe, only American Beauty Roses are grown.*

When the American Beauty received so much attention in the American horticultural magazines, the European horticulturists naturally became interested, and, in consequence ,ordered plants of same. In due course these plants flowered, and thereupon a French nurseryman recognized in it an old variety by the name of Mme. Ferdinand Jamin, and duly spread the information broadcast in all languages where advanced horticulture is known. This, as a consequence, temporarily at least, gave American nurserymen a bad name—that of renaming an old variety and redisseminating the same, thus causing much confusion in Rose nomenclature, besides placing American disseminators of floricultural novelties under the ban. In the case under consideration it was purely unintentional. Besides, if it is in any way consoling, the European distributors of novelties have been guilty of the same kind of "slips"—that of renaming and redisseminating old European varieties under new American names.

It would be interesting to learn the pedigree of the Rose under consideration, but am afraid it is beyond our efforts to secure same. As a digression, will state here, though in all probability, generally known, that in the vegetable kingdom there is cause and effect in the production of seed, that is to say, the farinaceous-like substance on the stamens must be applied to the pistils of the flowers before seed is produced, then, when given the proper opportunity, Mother Earth does the rest.

An old friend of mine, fifteen years ago, in the columns of the American Florist, made the statement that American Beauty was the best Rose introduced for the past twenty years, and although he was ridiculed to some extent at the time, nothing but the truth was stated as time has proven. The grand blooms of this Rose that have been produced since were not dreamed of at the time the statement was made, but the improved methods of culture and

* In Connecticut during the present Summer (1902), a rose house 800 feet long by 50 feet wide was built, in which are now growing American Beauty for the Boston market.

a more exacting demand as to quality for all classes of flowers has helped along the good work.

From the American Beauty Rose has sprung two varieties, namely: "American Belle" and the "Queen of Edgely." Both originated as what are known among gardeners and florists as "sports," that is to say, a shoot produced a flower that was distinct from those produced by the parent plant. Cuttings, "slips" or scions were made from said shoot, and in due course plants resulted therefrom and flowers produced which proved to be sufficiently distinct to warrant the adopting a different name. The color of the flowers of both sports, or, as Darwin would call them, "bud variations," were nearly alike, being pink and very much lighter in color than those produced on the original American Beauty, though the general habits of the respective sports were very different.

The Queen of Edgely is similar to "Beauty" in all respects excepting the color of the flowers, whereas in "Belle" there is a decided difference, which is noticeable at a glance; the leaves are smaller and the variety is less vigorous than either of the other two, consequently more difficult to manage, and that is why the American Belle has never become popular with the growers of cut flowers for market. Many experts believe that had it possessed the strong vigor of either its parent or its sister-sport, the Queen of Edgely, it would have been grown in almost as large quantities as is the American Beauty now grown and the "Queen" is expected to be grown. The latter was only introduced to general cultivation during the spring of 1901, whereas, the American Belle was disseminated in 1893. Both the American Belle and Queen of Edgely originated in Pennsylvania; the former, near Chestnut Hill, in Montgomery county, and the latter, near Bristol, Bucks county.

Other varieties of roses which have found favor with both flower buyers and the growers of roses, are the Tea-scented roses, Bridesmaid pink and the white one, Bride; and, strange as it may appear, both these originated as sports and both from the same source, namely ,from a rose sent out from France in 1869, named Mlle. Catherine Mermet, which has been almost entirely superseded by its offspring, Bridesmaid, being a brighter pink and more constant in its coloring. Two other varieties sported from "Mermet," namely, "Waban" and "Maid of Honor," both a darker pink in color than the original and more flat in form, neither of which became popular. The Bride appeared in 1885, and Bridesmaid in 1892, both in New Jersey; Waban appearing in Massachusetts and Maid of Honor in Ohio.

"Golden Gate" is of American origin, and is another very satisfactory rose to grow, having a strong constitution and produces its beautiful buds plentifully. Its name is a misnomer, however, being neither yellow in color, nor did it originate near to the Golden Gate

in California, but was raised from seed about the year 1890 by a Mr. Little, of New Orleans, La. In color it is creamy white, with a suggestion of yellow at the base, delicately tinted at the edges of the petals with pink. This variety has also sported a white form, to be known as "Ivory." Its real value generally is not at present known as it is not yet in general cultivation. It will be sent out during the present year (1902). It, however, is full of promise.

The "General Jacqueminot"—"Jack"—is not so much grown for winter blooming as it at one time was, being a one crop rose, and in order to try to keep up a continuous supply, several houses had to be grown of it and started at intervals of two weeks or so with that object in view. "Meteor," being crimson in color and everblooming in character, has largely taken its place. It is, however, not so good a rose as the older favorite in any way, excepting in its perpetual blooming qualities. It has little or no fragrance, and it is not so large nor so good in form, nor is it so pleasing in its crimson coloring. This rose was raised from seed in England. A newer crimson-colored variety, known as "Liberty," was distributed for general cultivation during 1900, which is very much superior to Meteor in every way, excepting that it is not such an easy doer, being more difficult to manage, but is giving excellent results with some growers. Liberty was a seedling raised in Ireland.

"Perle des Jardins," a yellow tea-scented rose of French origin, was sent out in 1874, and for a number of years was very popular, leading all others for a few seasons and entirely superseding "Marechal Niel," a yellow rose blooming in crops with rampant growing tendencies, so much so that special houses were built in which to develop its peculiarities. Although the "Niel" was a large flower and a beautiful shade of yellow, the very short stems upon which the blooms appear would debar it on social and general occasions in these days of long, stout and erect stemmed roses, and would find little or no favor now, excepting possibly on special occasions.

From the "Perle" quite a number of sports have originated. The first was "Sunset," which appeared near to Jersey City, N. J., about the year 1880, and was a fawn shade of yellow in color, and the leaves on the young growth took upon itself a more reddish tinge than appears on the older Perle. This also became quite popular. "Senator McNaughton," a creamy white in color, originated in Philadelphia, but was not grown to any extent because it was not nearly so good in any way, save possibly in its free blooming qualities, as is the most popular white rose to this day for winter blooming ever introduced, namely, the Bride. Another sport came from Canada, but this I am inclined to think sported from Sunset, and was called Lady Dorothea; the coloring was more intense in the latter than

the former. Pink Perle and White Perle were announced from Kentucky, but neither made any impression upon the trade for cut flowers. "Sunrise" was one of the novelties among roses last year (1901). It is a European production and is very beautiful. It may be a sport from Sunset, as it has the same general habit as that variety, both in foliage and coloring of the flowers, but very much intensified. This variety has also sported. It perhaps would be safest to say, reverted, for so far the flowers produced on the sported branch are apparently identical with Perle des Jardins.

"Mme. Cusin," another French Rose, had a few seasons of popularity. It is a delicate shade of pink in color, beautiful in shade and form, though somewhat flat, and in its lasting qualities after being cut from the plant, it is far superior to all others. This also sported in New Jersey, and the resultant variety is known as "Mrs. J. Pierpont Morgan." The color of the flower is much darker, being a bright, though light shade of solferino; the flower is also larger than "Cusin," and its good keeping qualities are, if possible, even better. And "Mrs. Morgan" has recently sported in Massachusetts, this time to an exquisite shade of delicate pink. It has been named "Mrs. Oliver Ames," and will be disseminated for general cultivation during the present year (1902).

All roses may be forced into bloom out of their natural season, provided proper care is taken in the preparation of the plants and the subsequent care of same; but those named are the most popular and easier to manage than are the hundreds to be found in catalogues and books of reference. The tea-scented section and the Hybrid Tea, because naturally everblooming, are the easiest to manage in this respect, and need little or no preparation excepting to give them generous treatment so that they may be kept growing; but all the buds and blooms should be kept pinched off during spring and summer, without taking any part of the shoots excepting one eye and leaf possibly with the flowers. We have thought it best to allow the flowers to come into full bloom before they are removed, because the shoots which are left on the plants seem to break into growth much quicker than when pinched off in the small bud state.

Before closing these rose notes, I must say that the old favorites of twenty-five years ago, as Bon Silene, pink in color, Safrano, fawn color, Isabella Sprunt, yellow—a sport from Safrano— and Papa Gontier, dark pink, are all really easier to manage than are the Bride and Bridesmaid, but the flowers are considered too small for present general requirements.

Roses for cut flowers, whether grown by the trade for sale or by amateurs, are grown in soil on tables or solid beds, as taking less care than when grown in pots, though just as good flowers may be

grown in pots as in any other way, but they require very much greater care in order to produce the finest flowers. American Beauty may be an exception to that rule, because the long stems required of this rose for the best and most exacting trade could not be produced in pots in sufficient quantity to pay.

It has been deemed advisable to thus treat upon roses at length, because if roses can be grown successfully in greenhouses, the operator thereof need not hesitate to undertake to grow any other plant, as roses are among the most difficult plants to grow and bloom successfully that we have.

The question of temperature in the growing of roses is one of the most important, and nearly all the sections mentioned need a few degrees difference at night if we would achieve the greatest success. For instance we have found the Meteor must have five degrees higher at night, namely, 65 to 68 degrees, than American Beauty, Queen of Edgely and American Belle require, which to do their very best should have from 60 to 62 degrees; kept as nearly the first named number of degrees as possible is the better. Bride and Bridesmaid, 56 to 58 degrees, and Bon Silene, Safrano, Isabella Sprunt and Papa Gontier, 54 to 56 degrees, and Golden Gate, 58 to 60 degrees. Perle, Sunset and Sunrise, from 60 to 62 degrees.

And a similar state of affairs exists with Carnations, though not quite to the same extent. Twenty-five years ago, from 40 to 45 degrees was considered about right for these popular flowers, but it is found now that for best results with the greatly improved varieties now being grown, a temperature about the same as that recommended and in use for roses at the same period is now in use for Carnations, namely, about 55 degrees.

New varieties of Carnations are so readily raised, and are being raised in all parts of the country, that it is quite difficult to keep track of them all. One, named "Prosperity," should be mentioned, however, because it is such a decided step forward that it seems today that it will be some time before it is distanced. This was sent out last year. It produces the largest flower of any variety in commerce, with stiff, erect and long stems, and is white, marbled with pink, in color.

A scarlet variety, named "Adonis," should be mentioned also, as it is one of those superior varieties that looms up head and shoulders above all the rest and looks as though it had come to stay for awhile. It is brilliant scarlet in color, of large size, and has the necessary stout and erect stem. The raiser of this novelty lives in Ohio, and has sold same to two firms jointly, one living in Indiana and the other in Philadelphia. The purchase price for control of the stock is said to have been $5,000. It will not be put into commerce until the spring of 1903.

The price just named does not begin to compare with the price which is said to have been paid by Thomas W. Lawson, of Massachusetts, for the variety which was named "Mrs. Thomas W. Lawson," after the Copper King's wife. Said price was $30,000, but so well was the variety advertised and so many plants had been sold that the purchase money was reported to have been returned by the end of the month of February, when there were still remaining three good months in which to sell this sterling novelty. It has proven to be a grand variety, giving excellent results generally, which is more than can be said for every new Carnation that is disseminated, many varieties being absolute failures in some sections of the country; whether it is the soil, the climate, or the water, which does not suit them has not yet been determined.

VENTILATION.

One of the most important matters in connection with the successful management of the greenhouse is the ventilation. It is very necessary, not only to keep the temperature within down to the mark, but it is also necessary in order to make as complete a change of the inner atmosphere as is possible.

In the olden time when greenhouses were frequently, we may say, generally built with sashes made for the purpose, the mode of ventilation was to slide them all down from the top, or as many of them as were left loose for that purpose, or according to the weather, and with the pipes for heating purposes arranged beneath the stages, thus a thorough circulation was made and the air changed.

Nowadays, however, few greenhouses are built with sashes, but instead, by what is known as a fixed roof, and arrangements are made whereby sashes are hinged at the apex and lifted by a machine made for the purpose, and by which the temperature may be regulated to a nicety.

There is an automatic ventilating apparatus on the market, which works with complete accuracy. It is operated by water pressure, but it cannot be operated satisfactorily unless there is guaranteed water pressure under control of not less than twenty-five pounds. This is a wonderful contrivance, and is a great labor-saving machine. Its cost, however, may seem to some prohibitory.

THE WATER SUPPLY.

The water supply is one of the first and most important matters to be considered in the starting of a greenhouse.

Not more than twenty years ago, even within city limits, cisterns were built inside the greenhouses in which to catch the rain-water which fell upon the roof, and many old-time gardeners to-day prefer the water secured in that way to any other for the purpose indicated, as they claim it is more soft and richer in the essential plant-foods than is found in the water in general use, as from springs or wells or from water companies. There is no doubt as to the truth of this matter, but only in a very small greenhouse is such a method practicable. A cistern is sometimes used in conjunction with a more complete water supply, the water from which is held in reserve for special purposes for some plants.

A never failing supply is what must be secured or the results might prove disastrous. Out in the country, away from a regular water supply furnished by a company or municipality, a drilled or a driven well or a never failing spring or creek with a windmill or some other motive power whereby the water could be lifted to a raised tank or to a point on higher ground should be secured. The higher the tank or whatever the storage method may be the better, if the expense is not too great, because a greater pressure to aid in distributing the water is secured thereby; and a heavy water pressure is advantageous in the hands of a careful person watering the plants, because it aids in getting the watering done more quickly when haste is not a detriment. In the hands of a careless operator a high pressure is sometimes a disadvantage, because more water is likely to be given oftentimes to the plants than is good for them when said plants cannot use same to advantage, as during dark, cloudy or rainy weather or in a low temperature. A careful man will, however, regulate the water supply at the spigot by turning same on only half or even less as the necessity of occasion requires. A strong pressure is a boon in any greenhouse on a bright, warm day, when the water may be given freely, both at root and on branch, and many insects which are among the banes of plant life under glass are kept in check by the judicious use of a powerful force of water; this applies especially to what is known as the red spider, which will be treated under the head of insects, later.

A windmill was referred to as a good power to bring into use to lift the water to an elevation, but when this is used the storage capacity should be large enough for at least a two weeks' supply, though a two

weeks' supply is very indefinite. As a guide, for a greenhouse 100 feet by 20 feet, 500 gallons a day on the average should be ample. It is surprising how much water our plants seem to need when the wind does not blow. In the months of August and September, we have very often noticed the wind is frequently not found working quite so faithfully as we would like it to do.

Other motive powers for pumping water besides wind, are steam and the various hot air engines, but the best water supply of all is, when obtainable, through some public works, as a municipality, borough, township, or by a private company.

The vast importance of the water supply will be realized when it has to be carried some distance on a bright, hot day. Personally, I have carried water from a little brook, a pailful in each hand, fifty feet from the nearest point to the entrance to the first of four greenhouses one hundred feet long. That process of watering appears tedious and very hard work now in the light of our present up-to-date hose in hand operations. At another place I have dipped water out of a cistern until same was empty, when we had to carry it from a pond two hundred feet away, and in hot, dry weather as soon as we had finished watering the plants at one end of the greenhouses we had to begin and go all over them again, so much water did the large plants need. It is frequently necessary in hot,dry summer weather to water plants twice a day.

In some large establishments arrangements are made whereby the water is heated in the winter-time, to a temperature of 65 to 70 degrees, but when pumped direct from a well where the water is 56 degrees there is no necessity for the water to be heated. And the advisability of heating water before using on the plants has frequently been questioned, because the atmosphere in the greenhouse should be at least 70 degrees before watering over the leaves of the plants is undertaken, and under those conditions the water would be in a very few minutes the same temperature as is the atmosphere therein.

DRAINAGE.

After the water question has been disposed of, drainage next suggests itself, and it is equally as important in greenhouse operations as it is upon the farm.

When solid beds are used in which to plant, or on a table or in a flower pot, it matters not which, we must feel reasonably certain that the drainage is ample. There is more necessity to look into this matter with some soils than there is in others; for instance, a

clay soil will require more care in that respect than will that having a more porous character.

Some florists think they are gaining an advantage by using drain-tiles so close together beneath the beds as to touch each other. The manner in which this particular plan is carried out is as follows: First, the inside of the greenhouse in which this style of a drained bed is to be built must be carefully graded, not necessarily perfectly level, but on a uniform grade. The walks or alley-ways should be laid out at convenient intervals, and after the bed has been thoroughly firmed to avoid as far as possible the liability to settling, the drain-tiles are arranged across the bed, the open ends of the tiles to present a straight line and to remain open at the outer edge of what will be the bed proper and define the line of the walk.

When sole-tiles are used it is deemed advisable to place same with the sole side or bottom upward, which will thus present a better surface for shoveling, because more level, when the old soil is removed preparatory to bringing in fresh soil and new plants. When it is decided that the tiles are to be arranged with the soles upward, it will be found necessary, after the base of the bed has been made thoroughly firm, to scatter sand thereon or the finer particles of screened ashes or similar loose material in which to place the tiles to hold them in position until the job is completed.

A wall is then built six, eight or ten inches high, the base resting upon the ends of the drain tiles, said tiles to remain open as before advised; in this way complete drainage is not only secured, but what is believed to be of equal importance, the free passage of air through the drain-tiles will counteract the possibility of sourness in the soil, thus going a long way toward insuring the well doing of the plants growing thereon.

The wall may be either of bricks, single, thick or concrete. Many retaining walls for solid beds are now being built with the last named material, which may be composed of coal ashes, gravel, sand and cement in proper proportions. Coal ashes are generally quite plentiful about a florist's establishment after he has started a short time, and I know of no better use to put them to than by building just such walls as above referred to, and as there are likely to be more of them in use in the future than there has been in the past, a few hints as to their construction will not be out of place at this time. Here is what the writer hereof prepared for the columns of the American Florist a few years ago:

"It is ten or twelve years since I first commenced to experiment in making walls with concrete. My first efforts were made with iron ore sand (refuse from the iron mines) and cement, but this became rather too expensive, on account of the long and heavy haul in addi-

tion to the first cost of the material. Sand of all kinds in this part of the country is scarce. In 1892 it occurred to me that if we could use coal ashes as a base for this purpose how much cheaper and convenient it would be. (Our brethren in the natural gas belt may or may not appreciate that statement.) I made known my thoughts to a friend in the profession, in whose judgment I had explicit faith, and he said "It won't do, my boy, the acid in the ashes will destroy the effectiveness of the cement." This certainly was a stunner, and I cannot now recall how I overcame the effects of it and ventured to make the experiment with the tabooed material, but I summoned up sufficient courage to do so, and we now have six of our greenhouses fitted up with walls of this kind, and they are apparently all right up to the present writing.

"We have never used any other but ashes from hard coal—anthracite—but believe the ashes from soft or bituminous coal could be used with almost if not quite as satisfactory results. The greatest trouble we find is in preparing the boards into which the materials, when properly mixed and ready for use, are deposited in order to make the wall. If we would have a straight and mechanical looking job when completed, the boards must be braced thoroughly by driving in stout stakes alongside at frequent intervals and then nailed together temporarily though securely at the top to keep them from spreading, which they surely will do when the wet and heavy concrete is shoveled inside the casings. There would be much saving of labor if two-inch or three-inch planks were used instead of inch-thick boards to form the frame work into which the material is dumped, because they would remain in position better and with fewer stakes.

"Not until all the moulds, as we may term them, in which the walls are to be cast are ready should the concrete be mixed, and then only such a quantity as can be used in half an hour. When, as above indicated, everything is quite ready to begin operations, we have a board or rather a number of boards nailed together, eight or ten feet square, with the joints as tight as it is possible to make them, or some of the cement will wash through with the water, and we proceed to mix the ashes and cement together, taking six or seven parts of the former to one of the latter, of which we find the better brands of Portland cement the most economical. These materials should be thoroughly mixed by turning three or four times, and should be done while they are quite dry, before any water is applied at all, after which water may be brought into use, and when every particle is thoroughly moist without being too wet it is ready to be applied to where the walls are to be built, and with reasonable activity, with enough men employed who can be used to advantage without being in each other's way, this part of the operation is a short one,

"The concrete should be pounded with a rammer gently though sufficiently until it has filled all the spaces completely, and topped off evenly to the level of the boards or planks. When as much of this part of the operation has been done nearing the end of the day or job, cement and sand should be thoroughly mixed, one part of the former to two of the latter, and mixed dry as before recommended for the ashes and cement, and also watered in the same way; this must be used to put the finishing touch to what will be the top of the wall, and with one man with a shovel to drop it at intervals along the top of the wall and another with a bricklayer's or plasterer's trowel—the latter being the most handy—a smooth face is put thereon that will be one of the most important and essential parts of the whole operation, for it is this which keeps the wall that is made of ashes and cement from crumbling; it certainly would crumble if the sand and cement were not applied, and at a time before the wall proper has had time to dry too much. A mechanical and smooth job may be made of the top of the wall if the operator will have a whitewash brush and a bucket of water convenient so as to apply it occasionally when the smoothing process is going on by the man with the trowel; a little water and the trowel following each other until a smooth surface is the result. If the "topping" part of the work just referred to is not done promptly, much time is lost in the completion of the job.

"After a few days—according to the weather and the time it takes to dry—the boards on the sides may be removed, and this, of course, must be done carefully; and these sides should receive a coat of cement in which sand has been mixed, in the same proportions as recommended for the top of the wall. Owing to the coarseness of the ashes used here, it is found when the boards are removed that although a more or less uniform or straight surface is presented, enough interstices will remain to give the sanded cement a good hold on the wall when plastered and, when thoroughly dry, the wall will be found as strong as though having been built of bricks, and at very much less cost.

"As to the cost of the materials, that depends upon what part of the country those who desire to build walls for solid beds in greenhouses are living in. In the natural gas region, ashes, which are so plentiful in other parts of the country, are at such a premium that they are quite out of the question in this connection, but in those sections probably, or at least possibly, sand or gravel or broken stone may be had for the hauling or at such a trifling cost that the same results may be obtained as low or at so little or no more cost that the difference is hardly worth considering; besides, it goes without saying that a wall made from sharp sand or gravel or broken stone, with cement in correct proportions is very much more substantial

than can possibly be made with refuse ashes, though I must say that I have yet to find that a break has occurred in the walls built as per above method, excepting when some accident happened that no wall could possibly resist.

"I have one house fitted up with this class of wall whereon a a table is built so as to get an idea if possible on which plan roses bloom the best, but so far I am not able to decide. There are so many contingencies arising in the growing of cut flowers during a whole winter season that it is very difficult to decide which is the better plan. One thing we are sure about and that is, a solid bed is easier to empty and easier to fill than is a table, and no time is lost as in the repairing of the tables. Other matters which must be taken into consideration, whether solid beds or tables are the better, is the nature of the soil in which the plants are to be grown, and above all, thorough and proper drainage must be secured; if not naturally, then it must be made artificially."

In the building of tables or stages upon which to grow roses, carnations or other plants, the boards used for forming the bottom of said tables are usually six inches wide and are placed from a half-inch to three-quarters of an inch apart, and over the bottom of the table coarse manure, straw or material of like character is spread thereon to keep the soil from trickling through and also to aid in securing the necessary drainage. Drainage in pots is provided for by placing broken pots, oyster shells or coarse coal ashes at the bottom thereof. Any pot smaller than that known as a two and a half inch pot is rarely or never "crocked"—which the drainage in flower pots is called.

To go back to the drainage of the solid beds again. Some soils are so well drained naturally that there is no necessity of going to the trouble or expense of furnishing any other form of drainage. Generally speaking, however, it is believed to be safer to furnish some sort of drainage. Drain-tiles are sometimes laid in the length of the bed, and the deeper they are laid in the earth the larger the area which a given line of pipe will drain. Other florists lay two lines of tile the length of the house in each bed, only as deep as the natural grade would be, and these ends are left open and project through and flush with the outer edge of the retaining walls, as much to aerate the soil as to drain same from surplus water. Coarse coal ashes, broken bricks, stones or similar rough material is frequently used at the bottom of bed for the same purpose.

Sub-irrigation is being experimented with to some extent, but so far a cheap method of constructing a bed where sub-irrigation could be practiced to advantage has not yet been adopted to any extent. It promises well, I am inclined to think, but just the right plan of operation has not so far been hit upon.

ASPECT.

There is some difference of opinion as to the proper aspect of a greenhouse to be used exclusively for the production of cut flowers in winter, the consensus of opinion favoring a position a few points east of south. This aspect favors the early morning sun getting in his good work, which is considered the most life-giving, consequently of the greatest value and best not for plants alone but all animated nature.

When a greenhouse is built in which to grow Palms, Ferns and Smilax and other classes of plants which are grown for their foliage alone, it makes little or no difference which aspect the greenhouse occupies. Palms assume a deeper green and develop equally as satisfactorily if they are not given too much sun at any stage of their existence. In Belguim, where many Palms and other foliage plants are grown for the London, Paris, Berlin, Vienna and St. Petersburg markets, boards are largely used in conjunction with glass in the construction of roofs of greenhouses in that country. By the use of said material there is a great saving, not only in the construction of a greenhouse, but in the heating of same in the winter season. A greenhouse with a roof built of boards, or partly so, will retain the heat much longer than will one covered wholly with glass, and the desired temperature therein can be maintained at much less cost for fuel. We are assured by those who have seen the Palms growing under conditions as above stated, that no plants could be more luxuriant or healthy than they were. At the price glass was selling in September (1901), namely $7.28 per box of fifty square feet, a great saving could be effected by the manner referred to. Glass fluctuated very much last year; for instance, in September, $7.28 was the price per box of fifty square feet, whereas, in November, the same quality of glass could be bought for $4.55, and twenty years ago $2.00 per box was about the price.

It will be understood that what is herein said is merely suggestive, that much latitude is allowed in the selection of a site for a greenhouse establishment, according to what will be grown therein and the available ground to be used therefor; and also in the selection of the material to be used in the building thereof, many believing that as much iron or steel as possible should be used so as to have them as nearly indestructible as such structures can possible be made.

HEATING.

After the water supply has been determined upon and the question of drainage and aspect duly considered, another serious matter to occupy the attention of those desiring to go into the greenhouse business, is the different methods of heating, because, generally speaking, quite early in the operation a hole in the ground has to be dug, known by the old-school gardener as a "stoke-hole." Though some of the very largest and up-to-date commercial concerns, where steam is used as the heating medium, do not advocate digging a hole in the ground at all nowadays, but by placing the boiler or boilers at the lowest point naturally, according to the lay of the land, and by employing a small, though a separate and independent steam-boiler, which is so constructed as to work automatically and thus pump the condensed water back to the boiler; but in a small way that plan of operation would seem to be out of the question, the water returning by gravitation being the most practical now.

Generally speaking, it is better to dig a hole, especially in general use when only in a small way, whether the heating be done by steam, hot water, or the old-fashioned flue, for a better draft is thereby secured, which is a very necessary accessory in the keeping up a good fire to heat to the desired temperature the atmosphere of the greenhouses to the required mark; and, besides, a cellar is a great convenience in which to store, when possible, the winter's supply of coal.

There are several methods of heating, but three only will be necessary to consider at this time. What is known as the old flue system, which is practically a furnace with the chimney running nearly horizontally with a gentle rise to the further end and the whole length of the greenhouse and sometimes back again, and in this way the heat is given off enroute or in transit, as it were, and thereby warms the house. This was the first method of warming greenhouses, and when only one greenhouse is all there is to take care of this is certainly the cheapest plan of all; and where a variety of plants, coming from the different quarters of the globe, are to be grown therein this plan offers more variations of temperature to suit same in a given length of house than any other, that is to say, without special preparations are made with hot water or steam with that end in view. We, however, do not recommend the flue system for heating greenhouses, as it has some grave disadvantages, the principal one of which is the liability of deleterious gases escaping from the flue into the greenhouse being very great, and plant-life

suffers in consequence, so much so that crops have been known to be total failures by the damage done to the leaves and flowers.

Hot water as a heating medium is perhaps the very best method of heating a greenhouse establishment in a small way that can be devised when the structures occupy not over 25,000 square feet to heat, because requiring less frequent attention than does steam. The main advantage of hot water over steam is, that there is not the same necessity of having a fireman up all night to attend to the fires when hot water is used, because so long as there is a handful of fire in the furnace there is sure to be some heat in the water; whereas, when steam is used, just so soon as the fire is not hot enough to make steam, then the pipes immediately become cold and on a freezing night damage is likely to result, either by the frost entering the greenhouses and killing the plants outright, or by so chilling them that many weeks might elapse before they fully recovered.

When, however, a greenhouse establishment has twenty-five thousand feet or over the glass under cultivation, it is better to use steam and employ a night fireman, and the right kind of a man who is willing to do other work during the night, especially in mild weather, there are lots of little jobs can be done to advantage, such as washing flower pots, putting in cuttings, and sometimes oven potting could be done. Great assistance can be rendered in the early morning by assisting to cut and pack the flowers for market, which in establishments of any pretensions, are shipped at least once and frequently oftener, every working day in the year and sometimes on Sundays. Flowers, being perishable, the quicker they are disposed of the better.

To return to the duties of the night firemen. They must watch the temperature closely. Many establishments are fitted up with electric thermostats to warn the proprietor or the manager or foreman when the temperature is too low or too high; this fact keeps many firemen on the alert when they would otherwise be indifferent and become careless. Self-registering maximum and minimum thermometers are sometimes used for the same purpose securely locked in a case so that they cannot be tampered with. There are several details to be attended to personally by the fireman besides shoveling on coal and keeping up steam. A pipe has to be "shut off" at this house, or a "crack of air" admitted through the medium of the ventilating apparatus, or an additional pipe "turned on" in another house in order to keep the atmosphere at the desired temperature. As before referred to, there is an automatic ventilating apparatus in use which is giving general satisfaction.

As to the fuel, whether it is best to use anthracite or bituminous coal, crude oil or natural gas must be determined by individuals for themselves. Natural gas, when same may be depended upon in un-

limited supply, would be my own individual preference. No shoveling on coal, no cleaning of the fires, no ashes to take out. What a boon!

In and near to Philadelphia there is quite a lot of what is called "buckwheat" anthracite or hard coal used. This buckwheat coal, however, is only used where steam is the heating medium. Some others within the city limits use coke, a by-product in the manufacture of illuminating gas, while still others are using bituminous or soft coal; the latter has its decided disadvantages on account of the dense smoke produced therefrom and the resultant "blacks," entering the greenhouses through the ventilators which are very damaging upon all classes of flowers, especially the whites and other delicate tints, and by said blacks falling upon the glass more or less shade is produced, something to be avoided in the growing of flowers in the winter season when every ray of sunlight should be allowed to come through the glass as nearly as possible unobstructed.

When a battery of boilers is arranged conveniently in a central position or as nearly so as possible, and the greenhouses radiate therefrom, one man can attend to a much larger place and better than he otherwise could. With all essential conveniences for a night man, he can attend to 75,000 square feet of glass in ordinary weather, but when severely cold, an extra man would have to be brought in to assist. When it is impracticable to put in an automatic ventilating apparatus, and the place is large enough to warrant the expense of an additional man to look after the temperature of the houses, then the fireman may remain at the boilers all the time and having nothing else to do or think about except to keep up the necessary steam pressure to assure a complete circulation of heat to the remotest corner of the establishment, is a very satisfactory arrangement.

As a rule, with the requisite amount of executive ability centered in the guiding head, the larger the establishment the easier it is managed and naturally the more profits result.

We do, however, hear of an automatic stoker—a machine to coal the fire when needed. This I have not seen in operation, but there is no doubt about its being successfully done in a few large establishments. With such a machine and an automatic ventilating apparatus, two of the most important matters are provided for. All that would be necessary in such a place with those contrivances would be a night watchman, with men located conveniently to be on call in case of accident during the night, because in many large establishments there are thousands of dollars worth at the mercy of the elements in case of a breakdown in the heating apparatus or the breaking of glass.

To return for a moment to the subject of heating. The very best,

because offering the least trouble and expense after the first cost, that I have heard of it in an establishment located at Helena, Montana, which is incorporated under the name of "State Nursery Company," the greenhouse department of which is heated by natural hot water. The hot water is conducted through the greenhouses in pipes, as is done when a boiler is used, excepting that no provisions are made for the water to return, flowing on after it has done its duty, apparently going to waste. The springs from which the water is taken are about half a mile away from the greenhouses, and the water is conducted in a wooden pipe under ground and has a fall of one hundred feet, which registers about thirty pounds pressure. The temperature of the water is 130 degrees when it reaches the greenhouses so that it takes more lineal feet of pipes to insure the atmosphere in the greenhouses being raised to the desired temperature than it does when the heating is done by the ordinary methods of steam or hot water as practiced in Pennsylvania. This item of information is introduced here incidentally to indicate the advantages that some florists have over others, especially out in far away Montana when the question of heating is under consideration.

DISEASES.

Mildew—so called probably on account of the mealy-like substance which is spread over the leaves of the plants affected—is the most common disease which affects roses and yet one of the easiest controlled. The very best way is to use preventives, which is done by using flower of sulphur mixed with about its equal in bulk with air-slacked lime, which is distributed with bellows made for the purpose into the atmosphere of the greenhouse to be operated upon. This effective mixture above described has been in use for some time, and its beneficial results were found out by accident. Florists and others who use sulphur in large quantities buy it by the barrel. During a rainy spell, which, by the way, is a good time to keep the mildew-killer active, the sulphur works sluggishly, on account, I presume, of its possible affinity for moisture; so in order to make it distribute more freely, some air-slacked lime, passed through a fine sieve, was added in about equal its bulk to the sulphur. This was found to be equally as effective as sulphur alone and more economical.

Many a careless hand wastes much of this material. The best way

to apply it and the most effective and economical way, is to use the bellows referred to, fill same with the mixture and with the outlet pointing upwards and the operator working the bellows and walking backwards, the atmosphere of the structure will become well filled with this mildew antidote, and in settling ,which it will do gradually, it does so quite evenly and not unsightly as it is likely to do if the spout of the bellows is allowed to point downwards and the material irregularly distributed as is too often done. Another preventive for mildew, is to mix sulphur with linseed-oil to the consistency of a paste and apply with a brush to the heating pipes. The fumes of the sulphur are by this method believed to kill the fungous germs which are always more or less present in the atmosphere, awaiting favorable conditions to develop.

"Black spot" *inonema ro* , among diseases is the worst enemy the rose has to contend with, and this applies to those grown both indoors and outdoors, especially among that class of roses known as the "Hybrid Tea," which has for its parentage the Hybrid Remontant, or June rose, on the one side and the Tea-scented rose —a native of China—on the other. The Tea rose gets its title from a peculiar tea-like fragrance and not because it resembles tea in any other way. The LaFrance and Meteor, and possible the celebrated American Beauty, belong to the Hybrid Tea class.

The American Beauty appears to be the most susceptible of all roses grown under glass to black spot, and when a bad case develops it is very, very hard to get rid of. Bordeaux mixture, the same as recommended for fruit trees, is said to cure it, also copperdine; but I must confess that I have never yet found much if any benefit from the use of either. Potassium sulphide is also recommended. Any of the above might be used systematically as a prevention, and doubtless with more or less gratifying results.

It has been found, in practice, that no matter how badly affected a rose may be with "spot," at the end of the cut flower season, say the latter end of June or early in July, if all the branches are cut close from the plants about six inches to three inches from the base of the plant, these same plants, when they start to make a new growth, will grow without the slightest sign of black spot, and it is not until the month of September, when the growth made is from three or four feet high and densely clothed with leaves, that signs of this dread disease reappears; and then the cause is no doubt on account of some indifferent treatment given the rose, or some climatic conditions favoring the development of the fungus that science has not yet been able to detect in time to effectively stop, and it is found that the more luxuriant are the plants in the autumn months the more liable are they to this disease.

The plan followed and the safest, is to pick off and destroy by fire

every affected leaf as soon as seen. If the plants can be safely carried through the late summer and early fall months without showing signs of black-spot, the danger from said disease is not so great, especially after the heating in the rose-houses has commenced, for little or no trouble will be experienced with it during the winter until firing is stopped in the spring, when it is again liable to appear at any time. And when it does make its appearance at the season of the year indicated, it spreads with great rapidity, being very difficult at that season of the year to combat. It is believed that the dew or any form of moisture upon the leaves and in the atmosphere favor the propagation and development of these disease germs, and as water must be directly applied vigorously to the underside of the leaf where that troublesome plant pest, the insect-mite known as red spider, takes refuge for self-protection, and as the water remedy recommended which is the only known method to dislodge him adds greatly to the moisture produced, it is readily realized how difficult it is to give water sufficient for all the needs of the plants and yet not enough to encourage the black spot scourge.

There are other diseases to which the rose is subject, but mildew and black spot are the most prevalent and those which give the most trouble and anxiety.

Carnations when grown under glass are liable to have quite a number of diseases. The one about which so much was said and which caused so much anxiety some ten years or so ago, was the so-called Rust (*Uromyces caryophyllinus*), but it does not possess the same terrors as it did at that time. In appearance it resembles smut in grain, the difference being that the black or dark brown dust-like material appears on the upper surface of the leaf and looks as though it were a bursted blister.

One which has caused, and is causing some anxiety to-day, is what was at one time known as *Bacteriosis*, now known under the scientific name of *Stigmonose*, and is the result of punctures by insects which are liable to infest Carnations. The insects responsible for this "puncture disease," are the most common of all plant-lice, namely, the green fly, or aphides, and to a lesser extent, thrips and red spider. The punctures made by these insects make it possible for the disease under consideration to develop. It goes without saying that to avoid the Stigmonose is to keep the plants free from insects. And the rust, strange as it may appear, is entirely gotten rid of by growing the plants under glass both winter and summer.

The present day carnations are a development from the hardy Dianthus Caroyphyllus of Europe, and some of the closely related varieties to-day will live out all winter in some parts of America when grown in a favored location. That the rust on carnation plants

could be gotten rid of in America by growing same under glass, which is a hotter and dryer climate than is that of Europe, does seem difficult to realize, yet such has proven to be the case. It is the result of what is termed an "accidental discovery." The writer hereof, before the American Carnation Society at its convention held in Boston a few years ago, along the lines under consideration, said:

"Having a seedling carnation that was good enough to send out as a novelty the following spring, and in order to get up as large a stock as possible I kept on rooting the cuttings until quite late in the spring or early summer. It was so late, in fact, and the weather so dry that those plants remained in thumb pots all summer under glass instead of being planted outdoors. After the general collection of carnations had been lifted in the fall, this particular seedling showed unmistakable evidences of being affected with the much dreaded rust. As soon as possible all the affected leaves were picked off and distroyed; but when the job was completed the plants appeared to be planted too far apart, so much foilage had been removed, and in order to fill up the spaces we made use of the small plants which were rooted late and had remained in thumb pots under glass all summer. They were planted between the rows or lines of the affected plants, and, strange as it may appear, the unaffected little plants on each side of those were never affected by the rust during the whole season, and the older plants never recovered from the effects of the disease. At that time the rust had not created quite such a profound impression upon growers as it did later. This point is introduced here in order to show how it came that I decided to try buttercup under glass all summer. I reasoned in this way, that if one disease could be combated by this treatment, why could not other diseases be combated by the same treatment, and I am pleased to be able to say that the results have been eminently satisfactory. And, to speak further, I believe that we will find that some of the choice varieties, if we wish to get the very best results from them, will have to be grown under glass all summer."

Since that time a modification of the cultivation of carnations has taken place. Instead of leaving the plants growing out of doors, as in the old way, to the end of September or sometimes even as late as immediately before damaging frost is expected, which varies according to location (in the vicinity of Philadelphia, however, it is about the middle of October, and some seasons it is a few days earlier and some a few days later than the time mentioned), now, in these days the first week in August is considered by a number of the most successful Carnation specialists to be the best time, and the date named for lifting is about the season when Carnations begin to make their most rapid and vigorous growth outdoors when the nights become

cooler with more moisture in the atmosphere from the dews and fall rains. That the wisdom of the course now pursued is very readily understood when we consider the greater length of time the plants are growing outdoors, the larger and more succulent they naturally become and the more violent the shock from the breaking of the roots when they were lifted, that the only wonder now is that such a more rational method of treatment had not been practiced earlier. The plants not being so gross in growth at the earlier date, they are not injured nearly so much in the transplanting, consequently are not so susceptible to any of the diseases to which Carnations are liable; especially is this the case when the plants are in a weakened condition from the effects of the greater disturbance of the roots when transplanting under the older practices.

The various fungicides are no doubt excellent as preventives, and should be systematically used for that purpose, but when disease does show itself the affected parts should be immediately removed and destroyed by fire.

Stem Rot, which its name implies, is the plant rotting off just above the ground line. There is no positive remedy for this disease. To-day a plant affected with this disease may to all outward appearances be enjoying the best of health, and to-morrow it will be withered and dead. This malady among Carnations, according to Professor Albert F. Woods, Chief of the Division of Vegetable Physiology and Pathology of the United States Department of Agriculture, Washington, D. C., at the meeting of the American Carnation Society, held at Baltimore last year, stated that it is brought about through two distinct kinds of fungi. One which is known scientifically as *Rhizoctonia*, or wet rot, develops most in acid soils, especially where there is much decaying organic matter. The *Fusarium* is the scientific name of the other, or dry rot, and is not so prevalent as is the former among Carnations. Lime is found to be an excellent preventive when used on the soil for the former. One grower secured excellent results when he used between fifty and sixty bushels to the acre to combat Stem Rot. The second, or dry-rot fungus, grows best in a soil slightly alkaline. It is said to be closely related to the fungus which is almost driving out the cotton industry in both North and South Carolina. There are hundreds of acres of land where cotton cannot be grown any more where said fungus is present. This fungus has been found to retain its vitality for five years. No fungicides have been found strong enough to entirely rid the soil of its presence, as there is always enough left in the soil to start the disease on the next cotton crop. For greenhouse purposes the soil may be sterilized with steam at 130 to 140 pounds pressure when every germ of all fungi would be killed, and weed-seeds also, which would be a de-

cided advantage. Some growers have thought that there is a possibility of the soil losing some of its fertility when sterilized, but the Professor stated that in some experiments with sterilizing soil for Violets no injury at all was apparent, instead the Violet plants grew entirely too rapidly. It is of course, for greenhouse purposes, that the sterilizing of soil is at all practicable. Some of our expert rose growers make a practice of systematically sterilizing all the soil used in their rose-growing operations, and they are prepared to prove that it pays to do so. Some soils, it is believed, contain more nematodes, or eel worms, than do others, and it is for the purpose of killing this troublesome little microscopic fellow in the soil that sterilizing is practiced for roses.

A disease called "Black Rust," but entirely distinct from that affecting Carnations, affects some greenhouse plants, Heliotrope and Verbenas, especially. The leaves affected show dark blotches thereon, and which, in a bad case, the leaves are more or less crippled. This is believed to be caused by one of the mite-insects, which require a strong microscope to detect. There is hardly any cure for this disease when in an advanced stage, and it is better to destroy the plants so affected entirely and start anew with clean, healthy stock. Stunted, half starved plants are the first, and generally the only ones, to take this disease, so that to avoid it, generous treatment is the one great thing needful to keep the plants healthy.

There are other diseases affecting plants, but those mentioned are the most troublesome, and in order to be sure that everything is being done that can be to avoid diseases in plants, cleanliness in every department in the greenhouse must be the watchword, and ought to be rigidly enforced; and it must be here emphasized that the various fungicides should only be depended upon as preventives, and not cures.

INSECTS.

The insect which bothers plant-life in greenhouses most, or in the greatest number, and at the same time the easiest to get rid of, is the "green fly," or plant-louse, one of the numerous species of aphis which has the power of reproduction to an extraordinary degree—too prolific almost to be fully realized.

The most common plan in practice towards destroying them is by fumigation, which means, in this case, to burn refuse tobacco stems, which are the midribs of the leaves of the fragrant wood (Nicotiana),

which may be obtained in bales from a cigar factory, or from many seed stores which keep same in stock for the convenience of customers.

The process is as follows: A small bunch of dry paper or shavings, with a few dry stems to give the same a start, is placed at the bottom of a can made for the purpose, with a perforated base to cause the requisite draft, then the stems, with which the can is filled, and which are expected to do the effective plant-lice killing, before the light is applied, should be a trifle dampened; by this means flaming is avoided, which should never be allowed, as the hot flame with the deleterious gases generated under those conditions are likely to do serious injury to many tender plants which may be within the structure operated upon, as Heliotrope, Mignonette, and some other plants. When the tobacco stems are not too damp to burn, yet too damp to flame, it is just in the proper condition to produce the smoke, or the nicotine fumes, which suffocates our plant-enemy—the green fly.

Tobacco dust, when not too fine, may be used also for fumigating purposes, and is put into operation by placing the material upon plain paper in a perfectly dry spot on the floor of the greenhouse, and with a few drops of petroleum ("coal-oil") at one end of the pile of tobacco dust, then with a lighted match, touch the spot whereon are the drops of oil, when it may then be allowed to burn until entirely consumed, as no harm to the plants will result.

Paper steeped in a solution of saltpetre (potassium nitrate) and dried is also used upon which to place tobacco dust and burn. In this case no petroleum oil is needed; by touching the prepared paper with a light the combustion of both tobacco and paper is complete, and without flame.

There is also what is known as Aphis Punk on the market, a peculiarly prepared paper, which is hung on wire in convenient places in the greenhouse, and when lighted, is allowed to burn. This must not be allowed to flame either, or similar damage before referred to is likely to result.

There are also a variety of liquids much in use nowadays, where nicotine or the extract of tobacco forms the base and principal part of this class of insecticides. Sometimes these liquids when reduced to the proper degree of solution are applied directly to the plants troubled with insects, by spraying. Another plan frequently in use is when the liquid is placed in some convenient vessel and hot irons are dropped therein, and in this way is evaporated, filling the atmosphere full of the insect death dealing vapor. Some of the more advanced florists are using an evaporating pan which is attached to the heating pipes; the liquid is placed in the pans and in due

course is evaporated into the atmosphere. When these have been used, no other means of green fly extermination is thought of, so thoroughly practical have they proven to be.

A spirit lamp is also used, attached to the bottom of a small vessel containing a highly concentrated insecticide, and when the lamp is burning the liquid is vaporizing, and in this and other methods of vaporizing, doing away with the clumsy methods of burning the tobacco stems altogether which is gradually becoming obsolete. The vaporizing of the different liquids is a step in the right direction, being equally as effective and far less troublesome and more agreeable for the operator than the old way.

To again refer to the pans attached to the one and a quarter inch steam pipes. It has been demonstrated that when in use in the palm houses, and the pans are filled with a tobacco extract regularly every night, neither mealy bugs nor scale insects will find a resting place therein or will be in any way troublesome. This applies principally when the young Palms are raised from seed at an establishment, which is equipped with the evaporating pans and none of the insects mentioned are brought there from a distance with other plants.

Roses and Carnations under glass are rarely or never bothered with either scale insects or mealy bugs, but Palms and Ferns are, and when once these pests obtain a foothold they are hard indeed to get rid of. Tobacco water sprayed on the Palms and Ferns twice each week systematically and intelligently applied, will rid the plants of said insects entirely. Many florists and gardeners, when they find their efforts are not rewarded sufficiently after the first few applications by a complete extermination, become impatient and disheartened and abandon the good work; when so easily discouraged all the work done up to that time will have gone for naught and the time and material as good as wasted.

Sometimes when a case of either of the two insects mentioned are found, or in fact any insect, it is often best to secure a soft piece of sponge and with soapy, warm or hot water—but it must not be hotter than 125 degrees or there is a liability of the leaves becoming damaged—the insects are "sponged" carefully off the leaves. Hot water up to the point above mentioned has been found to kill many insects, and that may be considered the cheapest insecticide obtainable.

Red spider (*Tetranychus telarius*) among insects, is the most persistent foe, and the hardest to conquer, when once well established, the plant-grower under glass, has to fight, so that the plant-lover must exercise the greatest care when introducing new varieties into his collection, so as to see that they are entirely free from all insect

life before being brought into contact with his own collection, and by that method go a long way towards banishing injurious insects from our greenhouses.

Because it has been observed that the little mite of an insect, known to gardeners and florists and all those who grow plants and flowers under glass as the "red spider," appears to increase and multiply more rapidly in the most dry and hottest part of the greenhouse, then the conclusion is reached and the rash statement is made that moisture in the atmosphere will effectually banish him. Nothing could be farther from the truth. When the only method of heating greenhouses known was the flue system, which was in vogue hundreds of years ago probably, and which, owing to its primitive methods of distributing the heat, that end or part of the greenhouse where the furnace was located was the hottest and dryest, and that is where the spider flourished and was doing the most damage; and because at the end farthest from the fire there were less of the insects referred to than there were at the hotter end of the house, the writers of those days were led to make the assertion that a moisture-laden atmosphere was death to this insect, and many writers ever since have perpetuated the same old story. Many latter-day scientists know that much that passes for scientific knowledge too often is not the result of observation and investigation, but is merely compilation.

Professor Cranefield is a daring investigator, and the results of his recent investigations are herewith taken from the columns of the American Florist:

"Is it necessary to maintain a moist atmosphere in the greenhouse in order to keep down the red spider? Will not the spider thrive as well in a moist air as in a drier air? According to the evidence of experienced florists the spider is most destructive to Carnations when the temperature of the houses is maintained at 50 degrees or above at night and 70 degrees to 75 degrees in the daytime, whether the air be moist or dry. When the houses are maintained at 38 degrees to 45 degrees at night and 10 degrees higher in the daytime the spider is rarely troublesome, regardless of the moisture in the air. Roses are affected more or less according to the temperature maintained, the higher the temperature the more abundant the spider, regardless of the moisture in the air. Palm and Fern houses are usually free from spider, not on account of the moisture in the air, but because of the almost daily syringing the plants receive, thus destroying the spider by force, and secondarily, of course, the fact that these species of plants are less susceptible to attack by the spider.

"During the protracted heat and drougth of the past summer in southern Wisconsin many species of trees and flowering plants,

notably Plums and Asters, were severely injured, in some cases killed outright by the red spider. This condition was no doubt largely, if not wholly, due to the lack of rain, the lack of the impact of rain drops on the leaves and consequent drowning of the insects rather than the lack of moisture in the air. Evidence in support of this theory was abundant in gardens where the plants were frequently and thoroughly syringed.

"Referring again to greenhouse work, in former articles on this subject which have appeared in the American Florist. I have noted the experiments in the plant houses at the Wisconsin Experiment Station, where live steam was allowed to escape into the houses for periods ranging from eight to twenty-four hours, completely filling the houses and without causing any injury or apparent inconvenience to the red spiders.

"In order to obtain more evidence on the subject an experiment was conducted last March in one of our plant houses as follows: A closed frame, sides, roof and ends glass, was placed on a side bench over steam pipes. In this frame was placed a variety of plants in pots, including Clotlilde Soupert roses, Coleus, Heliotrope, Tomato and other plants. The plants had all been carefully syringed for several days and were all apparently free from spider when placed in the frame. The air was kept moist almost to the point of saturation for several days with no bad results to the plants.

"At the end of a week red spider was introduced by dropping on the plants several badly infested leaves from a rose plant growing in another house. Now, according to the commonly accepted opinion, the excessive moisture in the air in this frame should have prevented any increase of the spider. The actual results, however, were wholly different, the plants becoming quickly infested and at the end of three weeks were wholly destroyed by countless millions of red spiders. Both temperature and moisture were maintained at a high point throughout the experiment, the glass sides of the frame and the foliage of the plants being almost constantly moist.

"While these experiments do not furnish conclusive evidence that red spider will thrive in a moist atmosphere there is in it 'food for thought.' Is it not true that the spider is kept in check wholly by the force used in syringing? Does any gain result from the daily wetting down of walks, etc., practiced by greenhousemen?"

Sulphur in its different forms is believed to bother red spider more than any other one thing. A combination insecticide, known as Sulpho-Tobacco Soap, which, as its title implies, is made of sulphur, tobacco extract and soap, I have found about the best and most effective in stopping the ravages of this little pest; but to do any good it must be used nearly daily among plants when badly affected if we

would have it produce the desired effect and restore our plants to health and vigor again.

A good force of water, say with at least thirty-five pounds pressure, applied directly beneath the leaves where red spider finds its resting and working place will be found to keep it from making much headway. The great disadvantage we are laboring under, especially in the dark, dull days of winter, is that we dare not use water on the foliage of roses too freely, or we run great risks of giving the plants more water than they need, especially on the leaves, and in that way encourage diseases that are even worse if possible than is the red spider.

SOIL.

Every tiller of the soil knows the importance of Mother Earth well tilled no matter what the crop. Any good, loamy soil properly prepared for a corn or any other farm crop, when the tiller is reasonably satisfied that it could not be improved upon, is all right to be used for nearly all plants grown in a greenhouse. If, however, the desire is to go to a little more trouble, then a few loads of sod from an old pasture lot should be secured and carefully piled up with some rich cow manure and ground bone and wood ashes, the two latter ingredients weight for weight in about equal proportions. The farm-yard manure will give all the elements of plant food, and the bone meal will give some ammonia and phosphoric acid, and the wood-ashes some potash additional and some lime. Place the sod grass side together and a layer of manure occasionally, about one load of manure to five loads of sod or good loam will be in about the right proportions, and an occasional sprinkling of the bone and wood-ashes, about one hundred pounds of each, would make an excellent compost. If this pile is put up in the fall, allow it to remain until the weather commences to get warm in the spring, then turn the pile over, taking care to break up the lumps should there be any, and mix well the whole together.

Soil for plants to be grown in a greenhouse should not be handled when it is wet, no more than it should for a farm crop. When preparing soil for large operations, the plan is to manure heavily a piece of old sod if possible with cow manure in the fall, and just as soon as the grass begins to grow, and before it grows too long so that it will plow down nicely and cover easily, it should be done without further delay, then a heavy roller should be passed over the soil as

plowed a few times when possible to compress same; then use the drag harrow freely, in this way most of the little holes will be filled and an almost level surface will be presented. Then a good guaranteed quality of bone should be evenly distributed over the whole, and the ground harrowed thoroughly again a few times to mix the bone and upper surface of the soil well together. That done, then apply about the same weight of good, dry, unleached wood ashes in the same way. These should also be well mixed by harrowing. The plot is kept continually stirred by harrowing, especially when sufficiently dry after rain, and the harrowing answers another purpose, that of keeping down the weeds. This soil is frequently taken into the greenhouses in from three weeks to a month after plowing, but never before three weeks, because on one occasion serious damage was done when taken in sooner.

Crimson clover is being used to furnish humus and nitrogen in some establishments with satisfactory results. Cow peas also are being used to plow under for soil for greenhouse purposes. It is a safe rule to go by, that a soil on a farm that will grow first-class crops thereon is a safe soil to use in greenhouses. Sometimes it is deemed wise when the soil is of a heavy clay nature to add road or bank sand to make the soil more porous. Coal ashes, when the rough cinders have been screened out, are frequently used for the same purpose, and with no deleterious effects.

For Ferns, soil from the woods, known among gardeners as leaf-mold, is often used with excellent results. Muck from a low lying meadow, after it has been piled up on higher ground where the frost, sun and wind have a chance at it for several months to sweeten same, is often used mixed with equal parts of clayey loam to advantage, though muck is not recommended for roses. Air-slacked lime with good results is also mixed with this class of soil to correct possible acidity before it is used for greenhouse plants in which to grow.

PROPAGATING.

The most natural way to increase and multiply plants is by seeds, and numerous occupants of the greenhouse are increased in that way; but there are other ways of multiplying the number of a given variety, and that is by "cuttings" or "slips," and this perhaps is the most fascinating part of a fascinating occupation. To take a sprig of a plant and insert it in soil or sand and in three or four weeks' time we find tiny roots have been emitted from the base thereof indicates success and which means an awakening of the senses to both young

and old, and the sensation incidental to the first attempt in propagating plants in this way is more readily imagined than described.

Grafting to increase in numbers some varieties of plants is frequently resorted to under glass, especially does this apply to roses. There is in some soils with some varieties of roses a decided advantage when grafted, and among the stocks used giving the most general satisfaction is one introduced into France and England from Italy half a century or so ago, and is known as the "Manetti" stock. The varieties of roses which show a marked improvement when grafted are what is known as the "Mermet" family, which consists of the Bride, a white sport from Mlle. Catherine Mermet before referred to, and Bridesmaid, another sport from the same variety which produces darker and brighter pink colored flowers than does the variety from which it sprung. Among the advantages claimed to be gained by grafting by many growers of roses for cut flowers in winter is, that the plants produce more flowers and flowers of better quality than they do on their own roots.

The varieties of roses referred to form roots very readily, as cuttings, when given the necessary care which consists of never allowing the sand in which the cuttings are inserted—which is generally known as a propagating bed—to become dry, nor to allow the cuttings to wilt by allowing them to be exposed unnecessarily long to the influence of the sun. Judicious shading of cuttings is at all times recommended, and a movable and not a permanent shading is considered the better, for if a cutting is rooted under a dense shade, the young plants, rooted under those conditions, are liable to have their constitutions impaired. Consequently material to be used as shading should only be placed over the cuttings when the sun's influence becomes too strong. Newspaper is very frequently used with which to break the fierce rays of the sun from the cuttings and is as effective as anything that can be used. If cuttings are once allowed to become dry and wilt, the chances of their ever forming roots is very remote indeed. On very warm days sprinkling the cuttings occasionally will be a great help towards keeping them fresh and in a possible growing condition. An atmospheric temperature of not lower than 56 degrees and not higher than 58 degrees at night and an under or bottom heat of ten degrees higher after the callous is formed, and the general temperature kept down in daytime as nearly to 65 degrees as possible, the cuttings should root in from twenty-one to twenty-five days and sometimes longer according to the condition of the wood used from which the cutting is made, while some varieties root in much less time than others.

Grafting is frequently resorted to because the subject which it is desirous to increase in numbers does not form roots readily, but that

is not the case with the varieties of roses under consideration, namely, the white flowering Bride and the pink Bridesmaid, for no roses root with greater certainty than they. The great advantage the Manetti stock, before referred to, possesses for grafting purposes, is its strong tendency to produce numerous and vigorous roots, thus re-enforcing any variety, upon which a successful union —by grafting—with it has been made, against the many vicissitudes plant-life is heir to, whether said plants are growing outdoors or under glass, more especially perhaps when growing under the latter conditions.

A serious trouble with some growers of roses in some soils has been found in the presence of the so-called eel worm, scientifically belonging to the nematode family. These little worms in some way chew and feed upon the roots, causing what is known as "club root" thereon, thus interfering with the regular functions of the roots, and in consequence the general health of the plant is impaired. When grafted upon the stock mentioned if the eel worm is present in the soil, the vigorous constitution of the stock in question has the power naturally to recuperate quickly, and therein is where its utility and strength lies.

There is another stock recommended under certain conditions for grafting purposes for roses, and that is the Rosa Multiflora, a wild rose of Japan. This stock, however, has been found too vigorous for the section of the tea-scented rose in general use for winter flowering, furnishing sap presumably more freely than the Tea roses mentioned above can elaborate to advantage. The American Beauty has so far shown no decided advantages when grafted on the Manetti stock, which, by the way, is itself increased by cuttings, whereas the Multiflora is very easily raised from seed, which is much the cheaper way to get up stock, and if the Beauty took kindly to the latter stock it might be advantageous to use it for that purpose, because Beauty does not root with nearly the same certainty as does a Tea rose. It may or it may not surprise some growers to know that Golden Gate and its white sport Ivory, with their natural vigorous constitution, are considered by other experts to be improved by grafting on the Manetti stock.

Before leaving the subject of grafting, it may be mentioned that dormant pieces, with two or three eyes and two and a half inches long or so, of the celebrated and popular Crimson Rambler rose, which is seen on every hand outdoors in full bloom in the month of June in and near to the larger cities, and grafted on any congenial stock—the Multiflora has been found admirable for this purpose—and given proper treatment under glass, may be had in full bloom in a four-inch pot the latter part of March or early in April, and such plants

make excellent gifts for friends, or would find ready sale if prepared with that object in view.

Carnations are easily raised from seed, but unfortunately out of one or two thousand young plants there may be no two alike and may be any other color than the variety which furnished the pollen or that which produced the seed, and two-thirds of the flowers are very likely to be single and of no practical value. But by seed is the way which such celebrities as "Mrs. Thomas W. Lawson," "The Roosevelt," "Prosperity," "Adonis," "Enchantress," and other meritorious varieties are brought forth; but to be absolutely sure that we will get the same color, form and size of any special variety, we must increase and multiply by cuttings. And what holds good in the case of roses in the propagating bed will serve as a guide to the management of Carnations, excepting that a cooler temperature is recommended for Carnations, from 52 to 55 degrees at night and not higher than 60 degrees in day time when possible and practical, with plenty of ventilation night and day, weather conditions permitting. Some varieties of Carnations are inclined to sport, so that a sharp lookout for a variation from the original is always in order.

Among the many favorite flowering plants for the greenhouse that may be raised annually from seed, are the Chinese Primrose (*Primula sinensis*), *Cineraria stellata* or the so-called hybrids from *C. cruenta*, and *Cyclamen*, all of which are deserving of a place in any and all cool greenhouses where pot plants are grown. All the above delight in an abundance of air on all favorable occasions, and a night temperature of 45 degrees will suit them admirably. This brings us to the subject of—

ANNUALS FOR WINTER BLOOMING.

Nearly all the annual flowering plants may be had in bloom in the winter-time, provided the seed is sown at the proper time. The Mignonette is an annual and is one of the most popular flowers for winter blooming that we have, principally on account of its unique and delicious fragrance. The size of the flower has been wonderfully increased during the past decade. This has been brought about entirely by selection. One of the pioneers in the improvement of the size of the flowers of the Mignonette states, that he secured seed from every source likely to have something superior to what was generally grown, and when all the plants resulting therefrom came into bloom, only one plant was set aside as approaching the ideal, and

from this one plant, seed was saved, and this rigid rejection was kept up for years until a vastly improved strain has been secured. And what has been done for the Mignonette may be done for nearly if not quite all the flowering plants grown; especially does this apply to annuals. At present the Mignonette is the most popular annual grown for cut flowers, and the commercial value has been raised from a dollar per hundred twenty-five years ago, to fifty dollars per hundred, the latter price being realized at Chistmas time a few years ago. Though at the present time, I regret to say, so high price is not maintained even for the very select because the high grade has become more plentiful.

To find out just when to sow the seed of annuals to have them at a given time, at Christmas for instance, some experimenting will have to be resorted to and careful observations made and notes recorded appertaining thereto. Mignonette for winter blooming is generally sown the latter part of July and the beginning of August, and as it is a difficult plant to transplant successfully, the seed is recommended to be sown where the plants are expected to grow and bloom; if in a bed under glass, after the soil is carefully prepared the bed is checked off a foot or so apart each way, a few seeds are dropped at the junction, exactly the same as is the general practice when planting corn. Other growers sow a few seeds in a three-inch pot. In all cases only one plant is left, and the thinning out is done as soon as possible after the plants become large enough so that the most promising one may be selected, thus giving same every opportunity to develop into a strong and vigorous specimen. And the plan adopted in the growing of Mignonette may with more or less modifications be carried out with other annuals. The methods of culture will have to conform according to the use to which the plant when fully grown is to be put. For instance, the Mignonette is not grown to any great extent as a pot plant, it not being sufficiently showy for that purpose, as it is grown principally for cut flowers. It is generally grown in a solid bed especially prepared inside the greenhouse, though we occasionally see some excellent specimens grown in pots.

Among other annuals that are successfully grown for winter flowering are the different varieties of Sweet Peas, and so far as these are grown exclusively for cut flowers. The dwarf or Cupid varieties might be grown as pot plants, but the climbing varieties, to make presentable specimens, would have to be grown in large pots with the top of a birch tree or some other equally twigy bush to climb upon. All the varieties of Nasturtiums might be tried, both dwarf and climbing varieties. Some varieties would be found, after a test possibly, to answer the purpose for winter blooming better than others. In England such selections have already been made suitable to the existing conditions there. Whether the dwarf varieties would pro-

duce flowers of sufficiently long stems to be of any practical value in America for cut flowers can only be known by experimenting. Certain it is that as pot plants the dwarf varieties grown close to the glass in full sunlight, and in comparatively poor soil, and care taken not to give too much water, and in a temperature of from 56 to 60 degrees at night, very showy plants must result.

Other hardy annuals besides those named may be mentioned, *Salpiglossis*, among which are the various colors in browns, yellows, and crimsons, beautifully veined in lighter or darker shades with occasional dashes of blue, giving color combinations difficult indeed to describe. There are dwarf and taller growing varieties of these also, but among the taller varieties there are none which might be given the term climbing.

Brachycome iberidifolia or Swan River Daisy, is dwarf and compact growing, with flowers both blue and white with darker center, and is very much like a refined form of the Cineraria. If grown dwarf and compact, these would make very beautiful plants for dinner table decoration.

Schizanthus in a variety of shades and colors as purples, lavenders, pinks and whites can be had in bloom in the winter without any difficulty whatever, and they are certainly very light, airy and graceful. There is a new variety known as *S. Wisetonensis*, which is likely to be heard of in the near future, as it has met with much favor in London recently.

In conclusion, let me admonish all who operate greenhouses, whether for pleasure or profit, to attend strictly to every little detail, for if anything requires strict attention in every detail, both large and small, it is greenhouse management. No matter whether for pleasure or profit, cleanliness must be the watchword, for no matter if there are a few meritorious specimen plants in a greenhouse or greenhouses, a lack of cleanliness detracts very materially from a place so operated, no matter how pretentious.

When a mixed collection of plants is grown they should be cleaned from decayed and decaying leaves and flowers and rearranged at least once a week. The variety in effect produced by judicious rearranging is another of the charms of a greenhouse, and it is needless hardly to say that empty pots and dead and dying plants should be removed without delay. Plants respond very gratefully whenever intelligent attention is given to their needs.